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EDWARD SINGLETON HOLDEN, Sc.D., LL.D., LITT.D.

BY W. W. CAMPBELL.

Professor EDWARD SINGLETON HOLDEN, first Director of the Lick Observatory, died at the U. S. Military Academy, West Point, N. Y., on March 16, 1914.[1]

Professor HOLDEN was born in St. Louis, Missouri, on November 5, 1846. He was graduated from Washington University, St. Louis, receiving the A. B. degree in 1866. He was presumably a student in that institution during the years 1862-66. WILLIAM CHAUVENET, author of the well-known *Manual of Spherical and Practical Astronomy*, was Chancellor of, and Professor of Mathematics and Astronomy in, Washington University during that period. It is probable that Mr. HOLDEN pursued astronomical studies more or less extensive with Professor CHAUVENET. In this connection, it is of interest to note that Mr. HOLDEN married Professor CHAUVENET'S daughter MARY in the year 1871. Those of Professor HOLDEN'S later associates who are now residing on Mount Hamilton do not remember that he referred specifically to having studied astronomy in St. Louis, but he did remark frequently that his interest in astronomical subjects had been aroused on the occasions of visits to Harvard College Observatory while his cousin, Professor GEORGE P. BOND, was director of that institution (1859-65). There are reasons for concluding that Professor HOLDEN'S equipment for astronomical pursuits was largely self-acquired, thanks to his wonderful power of absorbing knowledge, and that it came only in minor degree from formal studies of astronomy in the class room.

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[1] Professor HOLDEN underwent a surgical operation two years ago for an abscess in his side. From this he never fully recovered, tho he attended to his library duties until three weeks before his death. He was buried with military honors at West Point.

During the years 1866-1870 Mr. HOLDEN was a cadet in the U. S. Military Academy at West Point, graduating in the latter year. He ranked third in his class. During the academic year 1870-71 he was Second Lieutenant in the Fourth U. S. Artillery. In the following year he was Second Lieutenant in the U. S. Corps of Engineers, serving as Instructor in Natural Philosophy in the Military Academy, and during the year 1872-73 he was Instructor of Practical Military Engineering in the Academy. In 1872 he published an octavo treatise on *The Bastion System of Fortifications, Its Defects and Their Remedies.*

In March, 1873, Mr. HOLDEN resigned his commission in the army to accept appointment as Professor of Mathematics in the U. S. Navy, for service as astronomer in the U. S. Naval Observatory at Washington. In the Naval Observatory, Professor HOLDEN came immediately into close professional relations with SIMON NEWCOMB, serving as assistant to NEWCOMB in the work of the just-completed 26-inch Clark equatorial telescope. It is clear from historical developments, as well as from passages in NEWCOMB'S *The Reminiscences of an Astronomer,* that NEWCOMB was tremendously impressed with HOLDEN'S energy and ability. When Mr. D. O. MILLS, President of JAMES LICK'S first Board of Trustees, went to Washington in 1874 to consult with NEWCOMB concerning plans for the Lick Observatory, NEWCOMB "suggested that a director of the new establishment should be chosen in advance of beginning active work, so that everything should be done under his supervision. As such director I suggested that very likely Professor HOLDEN, then my assistant on the great equatorial, might be well qualified. . . . The necessity of choosing a director was not, however, evident, but communication was opened with Professor HOLDEN as well as myself to an extent that I did not become aware of until long afterward."[1]

It is an illuminating comment upon Professor HOLDEN'S promise as an astronomer of the future that he should be recommended, and probably tentatively selected, as the director of the proposed Lick Observatory, to contain the largest and most powerful telescope in existence, at a time when his astronomical experience had covered but little more than one year. Professor HOLDEN was then less than twenty-eight years of age. The appointment referred to was not made, as the First Board of Trustees resigned in 1875, following certain unsatisfactory relations with JAMES LICK, and a new board of entirely different personnel was appointed by LICK in 1875. Captain RICHARD S. FLOYD was president of the Second Board of Trustees, as well as of the Third Board, appointed in 1876, under whose auspices the actual construction of the observatory was conducted.

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[1] NEWCOMB'S *Reminiscences,* page 184.

Professor HOLDEN was sent to London in 1876 as a delegate from the United States Government to examine and report upon the South Kensington Loan Collection of Scientific Instruments, especially as to improvements in astronomical and geodetical instruments. While engaged in this service he met Captain FLOYD, and the plans for the Lick Observatory, proposed by Professors NEWCOMB and HOLDEN in 1874, were thoroly discussed. From that time forward Professor HOLDEN was freely consulted, as was Professor NEWCOMB, in the making of plans for buildings and instruments and as to the correspondence with astronomers, opticians, and instrument-makers.

While on the staff of the Naval Observatory, Professor HOLDEN made himself very familiar with the literature of astronomy; he prepared and published index catalogs of books and memoirs relating to nebulæ and star clusters, to the transits of *Mercury*, and to other subjects; he observed comets, nebulæ, satellites, double stars, etc.; he interested himself especially in the nebula of *Orion*, publishing historical notes and his own observations as a *Monograph of the Central Parts of the Nebula of Orion* (1882); he prepared annual reports on the progress of astronomy; he made contributions of value to librarians; he prepared and published a volume on *Sir William Herschel: His Life and Works* (1881); in collaboration with Professor C. S. HASTINGS, he prepared a *Synopsis of the Scientific Writings of Sir William Herschel* (1881); he published an investigation of the objective and micrometers of the

26-inch equatorial (1881); he wrote many popular articles for the magazines, and many semi-popular articles for scientific journals; and in collaboration with Professor NEWCOMB he wrote a textbook on astronomy (1880).

Professor HOLDEN was in charge of a small expedition dispatched by the Naval Observatory to Central City, Colorado, to observe the total solar eclipse of July 29, 1878. Of his party Professor C. S. HASTINGS was an official member and Mr. JAMES E. KEELER a volunteer member. The sky was clear, but Professor HOLDEN's visual observations in search of the hypothetical planet *Vulcan* failed to disclose any unidentified objects.

In 1881 Professor HOLDEN resigned his commission in the navy and accepted the directorship of the Washburn Observatory, University of Wisconsin, in succession to Professor JAMES C. WATSON, deceased. This position he held during the years 1881-85. He visited Mount Hamilton in 1881 to assist in the installation of the meridian circle, and to observe the transit of *Mercury*. He also visited Mount Hamilton in the fall of 1883 on the return trip of the eclipse expedition of that year to the South Seas. At Madison he organized and pushed the observational duties of the Washburn Observatory with vigor. He discovered and listed many red stars; he discovered a considerable number of double stars; he observed the 303 stars of AUWERS's fundamental catalog with the meridian circle; he observed the bright comet of 1882 and other comets of lesser interest; he observed the transit of *Venus* in 1883; he was interested in studies of HERSCHEL's Star Gauges, and collected statistics of stellar distribution from the charts of PETERS, WATSON, CHACORNAC and PALISA; and he made measures of the ring system of *Saturn*. In company with Professor HAGEN, he prepared and published a catalog of 1001 southern stars on the basis of TACCHINI's observations.

In harmony with his policy of providing opportunities for other astronomers, he invited Professor BURNHAM to make frequent and systematic use of the 15-inch Clark refracting telescope of the Washburn Observatory; and with this telescope BURNHAM discovered many double stars and observed a still greater number.

The National Academy of Sciences organized an expedition to observe the total solar eclipse of May 6, 1883, from the Caroline Islands. Appropriations in support of the expedition were made by Congress and from the Watson Fund of the National Academy. Professor HOLDEN was appointed chief of the party and scientific director of the expedition. Associated with him were four young astronomers whose names later became well known: Professor C. S. HASTINGS of Johns Hopkins University, Mr. E. D. PRESTON, Mr. S. J. BROWN and Mr. WINSLOW UPTON. The Caroline Islands, consisting of a few very small coral islands lying close together, are situated about one hundred and seventy-five miles northeast of Flint Island, where the Crocker expedition from the Lick Observatory, University of California, observed the eclipse of January 3, 1908. It was a serious question in Professor HOLDEN's mind whether the expedition of 1883 should locate on the Caroline Islands or on Flint Island. A French expedition under Monsieur JANSSEN reached the Caroline Islands a few days after the landing of the American party.

The experiences passed thru by many eclipse observers in the tropics fell to the lot of the observers in 1883: the sky was clear during the greater part but not all of totality, and during the partial phases there were clouds in abundance and some rain. The air in most tropical localities is so near the saturation point that the fall of temperature when the Moon is covering the Sun is sufficient to cause clouds and precipitation; and that the sky is clear one minute does not mean that the following minute may not bring clouds and the following five minutes rain.

Professor HOLDEN's expedition was successful in carrying out all the main features of the program. A visual search for the hypothetical planet *Vulcan* led to negative results. Spectroscopic and polariscopic observations of the corona were secured as planned. The details of the corona were observed visually. The times of contacts were estimated and the influence of the eclipse upon the meteorological elements was observed. The memoir on the eclipse of 1883 is a model in form, and is frequently referred to by past and prospective observers of eclipses.

In 1885 Professor HOLDEN was appointed President of the University of California and Director of the Lick Observatory, to serve in the former capacity until the observatory should be completed, and thereafter in the latter capacity. His services as President terminated with June 1, 1888, and on this date he assumed the active directorship of the Lick Observatory. During the last three years of the construction period he was very intimately associated with the Lick trustees as adviser. It was upon his advice and recommendation that Mr. JAMES E. KEELER, assistant to Professor LANGLEY, came to Mount Hamilton in 1886 to assist the trustees with the installation of the instruments, and with the understanding that he would become a member of the permanent staff, in charge of the department of spectroscopy.

Professor HOLDEN's term of office as the first Director of the Lick Observatory terminated by resignation on December 31, 1897.

An astronomer has said that "the first requisite for the director of a great observatory is to have a very clear notion of just what kind of work ought to be done, how it should be done, and then to give all the aid in his power to the investigator." Director HOLDEN selected the most promising men he could find in the United States to comprise the observatory staff. He assigned them definitely to lines of research which the future has shown to be of the highest importance. He gave them such opportunities to succeed as no other astronomer had ever enjoyed. In particular, he gave them great liberty of action and wished them success. The comments in the last two sentences are made in general terms, but they are also a reflection of my appreciation of the opportunities which came to me through Professor HOLDEN's office. To quote from NEWCOMB's *Reminiscences,* page 190:

> "The institution make its mark almost from the beginning. I know of no example in the world in which young men, most of whom were beginners, attained such success as did those whom HOLDEN collected around him."

The evidences of Professor HOLDEN's organizing ability and energy are written all over the Lick Observatory. Nor were these qualities confined narrowly to the internal work of the institution. The total solar eclopse of January 1, 1889, was effectively studied, on his initiative, by a well-equipped expedition from the Lick Observatory. The Astronomical Society of the Pacific is truly his creation. The Montgomery Library Fund of the Society, the Donohoe Comet-Medal Fund and the Bruce Gold Medal Fund were provided at his solicitation. He devised the unique regulations governing the bestowal of the Bruce Gold Medal, which ensure that the award made by the trustees of the Society shall be of unquestioned wisdom. In maintaining the relations of this observatory with other similar institutions thruout the world and in making the more important results of the Observatory's researches known to the scientific public Professor HOLDEN gave devoted and able effort.

His own scientific work in the Lick Observatory related principally to the photography of the Moon. He encouraged the study of his lunar photographs by astronomers in other institutions, and he published a lunar atlas comprising nineteen large sheets, the reproductions of enlarged photographs. He made occasional observations of the nebulæ and of the planets. His extensive administration duties did not leave him much time for personal research.

The last years of Professor HOLDEN's administration were marred by the existence of animosities in the observatory community, and by much ill-advised criticism in the newspapers. The time has not come for any member of the staff under Professor HOLDEN's administration to attempt a critical analysis of the situation, and I shall let a distinguished non-partisan speak. To quote again from NEWCOMB's *Reminiscences,* pages 192-193:

> "The term of HOLDEN's administration extended through some ten years. To me its most singular feature was the constantly growing unpopularity of the director. I call it singular because, if we confine ourselves to the record, it would be difficult to assign any obvious reason for it. One fact is indisputable, and that is the wonderful success of the Director in selecting young men who were to make the institution famous by their abilities and industry. If the highest problem of administration is to select the right men, the new director certainly mastered it. So far as liberty of research and publication went, the administration had the appearance of being liberal in the extreme. Doubtless there was another side to the question."

It is my duty to remove two erroneous impressions, so far as I here have the power. Many astronomers in the Eastern States, and a few in Europe, have been imbued with the belief that Director HOLDEN's growing unpopularity with his staff was occasioned in part at least by his desire to withhold from them the credit for their scientific work, and also by certain shortcomings in his private life on the mountain. How these widely prevailing views originated and spread I do not know. In my opinion they were absolutely without basis in fact: his extension of credits to colleagues and assistants was generous; and as far as I have ever heard any member of the observatory community speak, his private life amongst us was exemplary.

Professor HOLDEN's astronomical career practically terminated with his departure from Mount Hamilton in October, 1897. He resided in New York City until the latter part of 1901, where much of his time was devoted to the writing of popular articles and books on astronomical subjects of every-day interest.

From November, 1901, until his death he was Librarian of the United States Military Academy. When his former associates heard of this appointment they said without hesitation: "He will be wonderfully successful"; and so it seems he was. In 1907 the well-known journal, *Army and Navy Life,* inaugurated a series of biographies of *Distinguished Graduates of the U. S. Military Academy in Civil Life,* by beginning "this series of articles with a brief survey of the distinguished career of the Academy's most learned living alumnus, Dr. EDWARD SINGLETON HOLDEN," prepared by Captain E. G. DAVIS, U. S. A. I shall let Professor HOLDEN's biographer speak of his services to the library of the Military Academy:—

> " . . . He has labored unceasingly, within the means at his command, to make the library meet the legitimate needs of every instructor and every cadet.
>
> "He saw from the first the magnitude of this last great task which he has undertaken. He found the library fairly well supplied with books on every subject, but their contents were not readily available. His first task was to complete the collection so that every subject is now represented by the standard books that give its past history, as well as by the current periodicals which exhibit its present progress. Some 30,000 volumes have been added to the library since 1901, . . .

"All the new books of the library and all the military books, whether new or old, have been thoroughly catalogued and made available to instructors and others. A veritable mine of information has been opened for them in which they can find unlimited material for the extension of their professional studies or for original research in any field.

"Every nook and cranny of the library has been ransacked and Dr. HOLDEN has personally examined every paper in the records of the bureaus of the War Department from the beginning of 1838 (the date of the fire which destroyed the records at West Point), making copies of all the important Mss. So that now for the first time since 1838 the historical records at West Point are substantially complete. Many orderly books, etc., have been acquired by gift or purchase.

"All of this material has been catalogued and much of it has been thoroughly gone over, either by Dr. HOLDEN himself or, under his direction, by officers who have voluntarily assisted him in this work. . . .

"His report as librarian for the last year shows that about twenty-five per cent of the younger officers did volunteer work for the library and that more than one-third of the officers of the post were there engaged in serious work and many more at their own quarters. . . .

"Recently an officer, who was to deliver a lecture to the student officers at a nearby post, wrote to Dr. HOLDEN asking for assistance in the collection of historical data concerning the development of a particular military subject.

" 'Visit the library,' replied the doctor, 'and all our books and manuscripts relating to this subject will be placed at your disposal.'

"The officer came. He found a table piled high with books and papers, containing, perhaps, every treatment of the subject from the time of the Greeks and Romans down to the present. He was inclined to despair when he saw the mass of material before him. To wade through such a pile of books seemed an endless task. But to his astonishment he found that the work had been more than half done for him; he was furnished with a manuscript bibliography of his subject, which gave him in a moment just what the various books contained and told him where to look for it. He went away delighted and enthusiastic. Dr. HOLDEN has prepared similar complete bibliographies on every military subject. As soon as funds are available they are to be printed and distributed to the service. When this is done officers will know just what data is available for the study of any military subject in which they may be interested."

Professor HOLDEN's interests took a wide range. He has written and published on the bastion system of fortifications; on the number of words used in speaking and writing; on the celebrated cipher dispatches of 1876, relating to the election of a President of the United States in that year; on the treatment of pamphlets in special libraries; on studies in Central American picture writing; on a system of local warnings against tornadoes; on *The Mogul Emperors of Hindustan,* a delightful volume published in 1895; on *Mountain Observatories* (1896); on *Memorials of W. C. and G. P. Bond* (1897); on *Pacific Coast Earthquakes* (1898); a *Primer of Heraldry* (1898); a volume on the *Family of the Sun* (1899); *Real Things in Nature* (1903); *The Sciences* (1903); the *Centennial History of the U. S. Military Academy,* 1802-1902, Vol. II, containing a full bibliography of West Point for 1524-1902, of the Military Academy for 1776-1902, and of the writings of all graduates of the Military Academy during 1802-1902. There are many magazine articles on still other subjects.

Distinguished honors were bestowed upon Professor HOLDEN. He was elected Foreign Associate of the Royal Astronomical Society in 1884; a member of the National Academy of Sciences in 1885; and later to membership in the Astronomical Society of France, in the Italian Spectroscopic Society, in the American Academy of Arts and Sciences, etc. He received the degree of LL.D. from the University of Wisconsin in 1886, and from Columbia University in 1887; the degree of Sc.D. from the University of the Pacific in 1896; and the degree of Litt.D. from Fordham College in 1910. He served as a member of the Board of Visitors to the U. S. Military Academy in 1885, and of the Board of Visitors to the U. S. Naval Academy in 1896. The reports of the Boards of Visitors for those years were live documents. He was made a Knight Commander of the Ernestine Order of Saxony in 1894, and a Knight of the Royal Order of the Dannebrog in 1895; and the Order of Bolivar was conferred upon him in 1896.

Professor HOLDEN possessed abilities wonderful in many ways. His knowledge of literature, both general and scientific, including, of course, the literature of astronomy, was very extensive, and this knowledge appeared always to be at his immediate command. He enjoyed writing, he wrote rapidly and with a fine literary style. It is a remarkable fact that the heavy correspondence of the Lick Observatory was conducted by Professor HOLDEN's personal pen thruout his term of office. He did not utilize the services of a stenographer, and only an occasional letter was copied with the typewriter. His social abilities were of very high order. His conversation was entertaining to the point of brilliancy. His hearers did not always agree with his point of view, which he defended with vigor and skill, but no one could be found to deny that Professor HOLDEN had made the subject seem alive. His lamented death puts former associates into the reminiscent mood which accompanies the passing of a remarkably interesting man.

HISTORICAL QUOTATIONS.

By W. W. CAMPBELL.

A recent reading of early contributions to astronomical literature has brought me upon many interesting passages which have not been used by the principal historians of astronomy, tho I since fine that some of these passages are referred to by an occasional modern writer. I venture to quote on two subjects:

(a) The idea that the Milky Way is composed of vast numbers of separate stars goes back at least to Democritus (450 ± B. C.), but KANT's *Universal Natural History and Theory of the Heavens* (1755 A. D.) appears to offer for the first time an hypothesis of the general form and structure of our stellar system substantially in accord with present ideas.

"Mr. WRIGHT of Durham, whose treatise I have come to know from the Hamburg publication entitled the *Freie Urteile,* of 1751, first suggested ideas that led me to regard the fixed stars not as a mere swarm scattered without visible order, but as a system which has the greatest resemblance with that of the planets; so that just as the planets in their system are found very nearly in a common plane, the fixed stars are also related in their positions, as nearly as possible, to a certain plane which must be conceived as drawn through the whole heavens, and by their being very closely massed in it they present that streak of light which is called the Milky Way. I have become persuaded that because this zone, illuminated by innumerable suns, has very exactly the form of a great circle, our sun must be situated very near this great plane."—HASTIE's translation, page 30.

"Whoever turns his eye to the starry heavens on a clear night will perceive that streak or band of light which on account of the multitude of stars that are accumulated there more than elsewhere, and by their getting perceptibly lost in the great distance, presents a uniform light